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MENDELEYEV'S PERIODIC TABLE AND SOME PROBLEMS OF ATOMIC PHYSICS

by I. P. Selinov

[Note: The following is a condensation of an article that appeared in Uspekhi Fizicheskikh Nauk, Volume 44, No. 4 (August 1951), pages 511 to 526.]

Author suggests that Hubbard's periodic table be improved by the introduction of colors in his charts (cf: Henry P. Hubbard, Periodic Charts of the Atoms, 1947).

Interesting variations of the periodic system was suggested by professor S. A. Shchukarev. [No details were given. *the writer.*]

Author suggests that the new element astatin be named "mendely" in honor of Mendeleyev, who predicted its existence.

As seen from the periodic table, Iridium has two stable isotopes Ir^{191} and Ir^{193}. From the relative abundance of these isotopes an atomic weight of 192.2 should be derived instead of the figure 193.1 as published by the Committee of Atomic Weights [See the Bibliography, *cf: 10*]

A new scale of atomic weights should meet the following requirements:

1. For the unit of atomic weights an element consisting of only one stable isotope and therefore independent of the origin of the element should be chosen. In this case the isotopic atomic weight will coincide with the atomic weight of the element.

2. In order that atomic weights of all isotopes be close to the mass numbers it is necessary that the mass defect of the stable isotope of the chosen element possess an average value between the extreme values on the curve of

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mass defects. For this reason we cannot chose e.g. hydrogen $_1H^1$, because the atomic weights of heavy isotopes in hydrogen units will be smaller than the mass numbers by nearly one and half.

3. The chosen element should be convenient for mass-spectrographic measurements and its stable isotope sufficiently well measured.

4. This element should combine readily with various elements.

5. Introduction of the new scale should not essentially alter atomic weights accepted in chemical practice, computed with respect to oxygen with atomic weight equal to 16.000.

All these requirements are met by only one element, and this is fluorine. Fluorine isotope F^{19} is just as convenient a unit as O^{16}.

/In similar vein the author discusses also the following subjects: isotopes and atomic weights; periodic rules governing electron shells and atomic nuclei; discovery of new radioactive elements; problem concerning the upper limit to the periodic system./

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/Note: The following represents the legend to a large insert chart of the periodic table, appearing in the original.7

MENDELEYEV PERIODIC TABLE (1951)

[sample]

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$4f^6 6s^2$: Electron configuration in the periphery of atomic shells (see square above).

150.1 5 m 6^2: Atomic weight; that marked by asterisk is the atomic weight obtained from values of abundances and isotopes masses, and for radioactive elements (Z > 83) the mass number or the mass of the longest-lived isotope.

Sm: Symbol of element. The symbols Eka-Tm, Eka-Yb designate unknown element-homologs of Tm, Yb and other elements.

Z is the ordinal number of the element; Z equals the number of electrons in a neutral atom and the number of protons in the nucleus (defining the nuclear charge).

The big numbers are mass numbers of beta-stable (stable and alpha-radioactive) isotopes.

The smaller numbers are mass numbers of beta-radioactive isotopes undergoing transformation by release of electrons or positrons or by K-capture of electron; underlined are long-lived isotopes contained in the natural mixture of isotopes of the element.

The medium line of mass numbers are isotopes in which it is established or it is assumed that the binding energy of protons and neutrons in the nucleus is stronger than in their isobars. Assumed values are placed in parentheses.

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